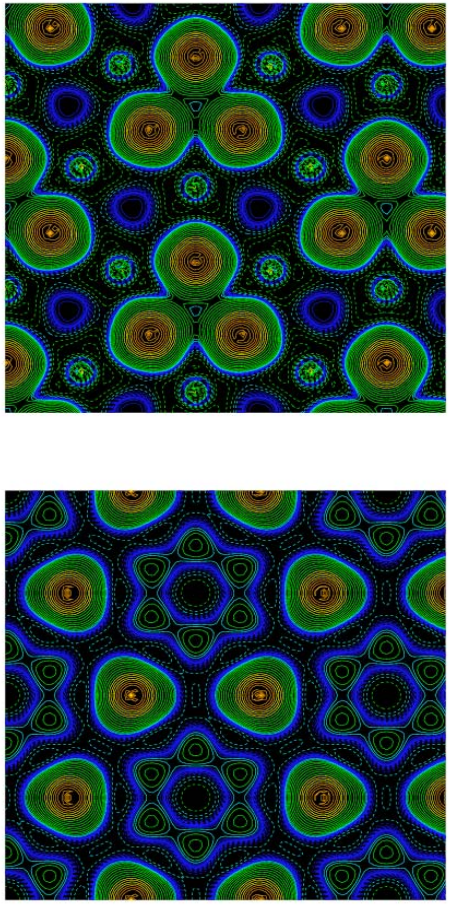
# Novel Magneto-electronic Materials for Spin Based Electronics ("Spintronics")

**A.J. Freeman & J. B. Ketterson**

**Northwestern University,** **DMR-0244711**

Pursued worldwide, the exciting new nanotechnology field of "Spintronics" seeks to exploit the possibility that the electron's spin, in addition to its charge, be applied to process and store information. Current research concentrates on the generation and manipulation of spin polarized electrical currents. Here we present results of our combined theoretical and experimental program on a new room temperature ferromagnetic semiconductor $Mn_5Ge_3$ with a $T_c$ of 300K. This material can be successfully grown on Ge(111) and appears to be an excellent candidate for efficient high spin injection room temperature spintronics applications.



Spin density contours in two planes perpendicular to the c axis of of Mn5Ge where the solid (dashed) lines denote positive (negative) spin density.

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## Education:

U. S. and Italian graduate students and postdocs are benefiting from the training and learning experience. At NWU, last summer's REU student, Nicholas Hatcher from Creighton University, will return as a graduate student this fall. A second REU student, Steven Hahn from Lawrence University, is currently receiving training in our research group. An 8$^{th}$ grade student, Ian Finder from Haven Jr. High School in Evanston, IL, continues an active internship here at NWU. Graduate students S.H. Rhim and W. Mu are working on theory and experiment.

## Societal Impact:

Electronics based on the spin degree of freedom of the electron has the potential advantages of non-volatility, increased data processing speed, decreased electric power consumption, and increased integration densities compared with conventional semiconductor devices.